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IOT BASED SMART HOME AUTOMATION USING SOLAR PHOTOVOLTAIC SYSTEM

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ABSTRACT: Wireless devices monitoring and controlling using IoT (Internet of Things) and solar energy is a system designed to remotely monitor and control various devices wirelessly, using solar power for sustainability. The system incorporates IoT technology to enable real-time monitoring and control from anywhere with internet connectivity. Solar energy is utilized to power the devices, making the system eco-friendly and reducing dependency on conventional energy sources. The system consists of sensor nodes, actuators, a central IoT gateway, and a cloud-based platform for data storage and analysis. The sensor nodes collect data from the environment, such as temperature, humidity, light intensity, and motion. This data is transmitted wirelessly to the central IoT gateway, which processes the data and sends control signals to the actuators based on predefined rules and user commands. The use of solar energy allows the system to operate autonomously, making it suitable for remote locations or areas with limited access to electricity. The cloud-based platform enables users to remotely monitor the status of devices, receive alerts, and control them as needed. Overall, the system provides an efficient, sustainable, and flexible solution for wireless devices monitoring and controlling using IoT and solar energy.

KEYWORDS: Solar power, Charge controller, IoT, Sensors, Battery, 16*2 LCD, Relay, ESP8266 Micro Controller.

I.INTRODUCTION

Solar home automation integrated with the Internet of Things (IoT) presents a promising avenue for sustainable and efficient energy management in residential spaces. This project provides an introductory overview of the concept, discussing the integration of solar power generation with smart home technology and IoT devices. By leveraging renewable energy sources and advanced automation systems, solar-powered smart homes can enhance energy efficiency, reduce costs and contribute to environmental conservation. This project explores the components, benefits, challenges, and potential applications of solar home automation with IoT, aiming to inspire further research and adoption in the field of sustainable living.

Brief overview of the rising demand for sustainable energy solutions in residential buildings. Introduction to the concept of solar home automation and its potential impact on energy efficiency and sustainability. Solar Power Generation: Explanation of solar photovoltaic (PV) systems and their components. Overview of solar panel installation, operation, and maintenance.

Smart Home Automation: Introduction to smart home technology and its role in enhancing convenience, security, and energy efficiency. Overview of smart home devices such as sensors, actuators, and controllers.

Integration of Solar Power with IoT: Discussion on how IoT technology can be integrated with solar power systems to enable real-time monitoring and control. Explanation of IoT-enabled devices and communication protocols used in solar home automation.

Benefits of Solar Home Automation: Exploration of the environmental, economic, and societal benefits of adopting solar home automation solutions. Case studies demonstrating energy savings and improved efficiency in solar-powered smart homes.

Challenges and Considerations: Identification of challenges such as initial costs, compatibility issues, and cybersecurity concerns. Discussion on strategies to overcome these challenges and ensure successful implementation.

Potential Applications: Overview of potential applications of solar home automation in residential settings, including energy management, remote monitoring, and demand response. Discussion on emerging trends and future directions in the field.

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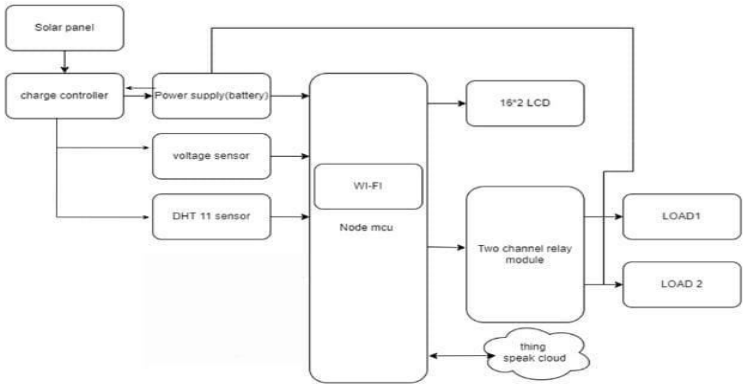
II. PROPOSED RESEARCH WORK

Internet of thing is growing network of everyday object, from industrial machine to consumer goods that can share the information and complete task while you are busy with other activities Because of the advanced development in computer technology, the microprocessors are not only on the desktop but also exist everywhere wireless devices monitoring and controlling Swallows us to control household appliances like light, door, fan, AC etc. It also provides wireless devices monitoring and controlling and emergency system to be activated. wireless devices monitoring and controlling not only refers to reduce human efforts but also energy efficiency and time saving . It is obvious that microprocessors are embedded in electronic appliances in our home today. In the past, the appliances are working on standalone and cannot cooperate with one another. But in the recent years, these appliances can be monitored and controlled by embedded microprocessors and be displayed on terminals.



Flg1: Block Diagram of Solar Based Home Automation Using IOT

COMPONENTS

(i) ESP8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability, widely used in IoT projects for its compactness and versatility. It enables easy connectivity and control of devices over Wi-Fi networks, making it a popular choice for DIY electronics enthusiasts and professionals alike.

(ii) SOLAR PANEL

Solar panels convert sunlight into electricity using photovoltaic cells, offering a sustainable and renewable energy solution for powering various applications, from residential homes to spacecraft. Their efficiency and environmental benefits make them a key player in the transition towards clean energy sources.

(iii) SENSORS

Sensors are devices that detect and measure physical properties or environmental conditions, such as temperature, pressure, or motion, converting them into electrical signals for analysis and control in various applications, from industrial automation to consumer electronics. They play a crucial role in gathering data for monitoring, decision-making, and improving efficiency in numerous fields.

(iv) 16*2 LCD

A 16*2 display typically refers to a liquid crystal display (LCD) with 16 characters per line and 2 lines, commonly used in electronic devices such as digital clocks, small appliances, and DIY electronics projects. Its compact size and simplicity make it suitable for displaying basic information in a variety of applications.

(v) RELAY

A relay is an electromechanical switch that controls the flow of electricity by opening or closing circuits, commonly used to control high-power devices with low-power signals in applications such as home automation, industrial machinery, and automotive systems. It provides isolation between the control signal and the high-power circuit, ensuring safety and reliability in electrical systems.

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III. WORKING

Solar home automation using IoT involves integrating solar panels to generate electricity, which powers devices and sensors connected to an IoT platform. The platform enables remote monitoring and control of various home systems such as lighting, heating, cooling, and security. Solar energy harvested during the day is stored in batteries and used to power the home during the night or when sunlight is insufficient. IoT technology facilitates intelligent automation, allowing users to optimize energy usage, adjust settings remotely, receive alerts, and track energy consumption, leading to increased efficiency, cost savings, and environmental sustainability.

Solar Power Generation: Solar panels installed on the roof or in a suitable location harness sunlight and convert it into electrical energy through photovoltaic cells. This energy production is often variable based on factors like weather conditions and time of day.

Battery Storage: To ensure continuous power supply, especially during periods of low sunlight or at night, solar energy is stored in batteries. These batteries, typically rechargeable ones like lithium-ion batteries, act as energy reservoirs, storing surplus energy generated during the day for later use.

IoT Integration: Various devices and sensors within the home are connected to an IoT platform via wireless communication protocols such as Wi-Fi, Zigbee, or Bluetooth. These devices can include smart thermostats, lighting systems, security cameras, motion sensors, and more.

Remote Monitoring and Control: Through the IoT platform, homeowners can remotely monitor and control different aspects of their home environment. They can adjust temperature settings, turn lights on or off, activate security systems, and even receive real-time alerts about any unusual activity or changes in energy consumption.

Data Analytics: The IoT platform collects and analyzes data from sensors and devices to provide insights into energy usage patterns, system performance, and potential areas for optimization. Machine learning algorithms can also be employed to predict energy demand, optimize energy storage, and automate certain tasks based on learned patterns.

Energy Optimization: With access to real-time data and analytics, homeowners can optimize their energy usage to minimize waste and reduce costs. For instance, they can schedule appliances to run during peak solar production hours, prioritize energy-efficient devices, and implement smart energy management strategies.

Scalability and Expandability: Solar home automation systems using IoT are highly scalable and expandable. Additional devices and sensors can be easily integrated into the existing setup, allowing homeowners to customize and expand their automation capabilities according to their evolving needs and preferences.

Environmental Sustainability: By leveraging solar energy and implementing smart automation, homeowners can significantly reduce their reliance on conventional energy sources, leading to lower carbon emissions and a smaller environmental footprint. This aligns with global efforts to promote renewable energy adoption and combat climate change.

Overall, solar home automation using IoT empowers homeowners with greater control, convenience, and efficiency in managing their home environment while promoting sustainability and environmental responsibility.

IV. CODE

```
#include <LiquidCrystal.h>
const int rs =D2, en =D3, d4 =D4, d5 =D5, d6 =D6, d7 =D8;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
#include "ThingSpeak.h"
#include <ESP8266WiFi.h>
const char ssid[] = "project";        // your network SSID (name)
const char pass[] = "12345678";   // your network password
int d1=D0;
int d2=D1;
int vs=A0;
#include "DHT.h"
#define DHTPIN D7
#define DHTTYPE DHT11
DHT dht(DHTPIN,DHTTYPE);
int statusCode = 0;
```

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```
unsigned long lastTime = 0;
unsigned long timerDelay = 16000;
WiFiClient  client;
//---------READ Channel Details---------//
unsigned long counterChannelNumber =324212;            // Channel ID
const char * myCounterReadAPIKey = "GV9QMFEJZ2ZL57TP"; // Read API Key
const int FieldNumber1 = 1;
//---------WRITE Channel Details---------//
unsigned long myChannelNumber =2499655;
const char * myWriteAPIKey ="QHSI90AL4U3CUE0J";
String strs[8]={"0","0","0","0","0","0","0","0"};
int StringCount = 0;
int prv=0;
void setup()
{
  dht.begin();
  WiFi.mode(WIFI_STA);
  ThingSpeak.begin(client);
  Serial.begin(9600);
  lcd.begin(16,2);
  lcd.setCursor(4,0);
  lcd.print("WELCOME");
  lcd.setCursor(0,1);
  lcd.print("SOLAR HOME AUTO");
  delay(2000);
  lcd.clear();
   pinMode(d1,OUTPUT);
   pinMode(d2,OUTPUT);
   digitalWrite(d1,1);
   digitalWrite(d2,1);
   pinMode(vs,INPUT);

}

void loop()
{
  int t = dht.readTemperature();
  int h=dht.readHumidity();
  int vval=analogRead(vs);
  if(vval>250 && vval<500)
  {
    vval=6;
  }
  else if(vval>100 && vval<250)
  {
    vval=4;
  }
  else if(vval>500 && vval<700)
  {
    vval=9;
  }
  else
  {
    vval=0;
  }
  lcd.clear();
  lcd.setCursor(0,0);
```

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```
  lcd.print("T:"+String(t)+" H:"+String(h));
  lcd.setCursor(0,1);
  lcd.print("V:"+String(vval))/100;
  delay(200);
//  Serial.println(t);
//  Serial.println(h);
//  Serial.println(vval);
  //----------------- Network -----------------//
  if (WiFi.status() != WL_CONNECTED)
  {
    Serial.print("Connecting to ");
    //Serial.print(ssid);
    delay(1000);
    while (WiFi.status() != WL_CONNECTED)
    {
      WiFi.begin(ssid, pass);
      delay(5000);
    }
    Serial.println("Conn.. to Wi-Fi");
    Serial.println("Succesfully.");


  }

  //----------------- Channel 1 -----------------//
  int temp = ThingSpeak.readLongField(counterChannelNumber, FieldNumber1, myCounterReadAPIKey);
  statusCode = ThingSpeak.getLastReadStatus();
 if (statusCode == 200)
  {
//    if(temp !=prv)
//    {
//    Serial.println(temp);
//    prv=temp;
//    }
  if(temp==1)
  {
    digitalWrite(d1,0);

  }
  if(temp==2)
  {
     digitalWrite(d1,1);
  }
   if(temp==3)
   {
     digitalWrite(d2,0);
  }
   if(temp==4)
   {
     digitalWrite(d2,1);
  }
  }
  delay(100);
//
if (Serial.available())
{
String rcv = Serial.readStringUntil('\n');
```

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```
if ((millis() - lastTime) > timerDelay)
{
  StringCount=0;
    while (rcv.length() > 0)
 {
   int index = rcv.indexOf(',');
   if (index == -1) // No space found
   {
     strs[StringCount++] = rcv;
     break;
   }
   else
   {
     strs[StringCount++] = rcv.substring(0, index);
     rcv = rcv.substring(index+1);
   }
 }

 ThingSpeak.setField(1, strs[0]);
 ThingSpeak.setField(2, strs[1]);
 ThingSpeak.setField(3, strs[2]);
 ThingSpeak.setField(4, strs[3]);
 ThingSpeak.setField(5, strs[4]);
 ThingSpeak.setField(6, strs[5]);
 ThingSpeak.setField(7, strs[6]);
 ThingSpeak.setField(8, strs[7]);
 int x = ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);
 if(x == 200){
  delay(10);
  }
else{
  delay(10);
  }
  lastTime = millis();
 }

}
  delay(1000);
}
```

V. RESULT AND DISCUSSION

Solar home automation using IoT culminates in a seamlessly integrated and sustainable living environment. With solar power as the backbone, coupled with intelligent IoT technology, homeowners enjoy enhanced comfort, efficiency, and control over their home systems. This holistic approach not only reduces energy bills but also contributes to a greener, more environmentally conscious lifestyle, epitomizing the future of smart, eco-friendly living.

Solar home automation leveraging IoT epitomizes a harmonious synergy between renewable energy and cutting-edge technology. From effortless control of household systems to optimized energy usage and reduced environmental impact, it encapsulates the pinnacle of modern living. Ultimately, it offers homeowners not just convenience and savings, but a tangible step towards a sustainable future, where homes actively contribute to a cleaner, greener planet.

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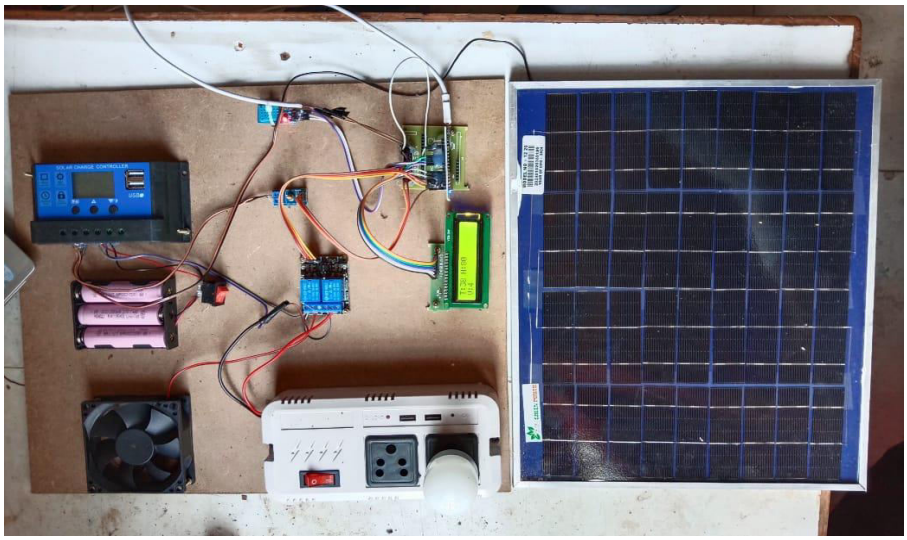

Flg2: Hardware kit of Solar Based Home Automation Using IOT

VI.CONCLUSION

The wireless devices monitoring and controlling using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The Solar-based Home Security and Home Automation System not only ensures enhanced security but also contributes to a sustainable and eco-friendly lifestyle. The integration of solar power and IoT devices offers a modern solution for energy-efficient and intelligent home management.

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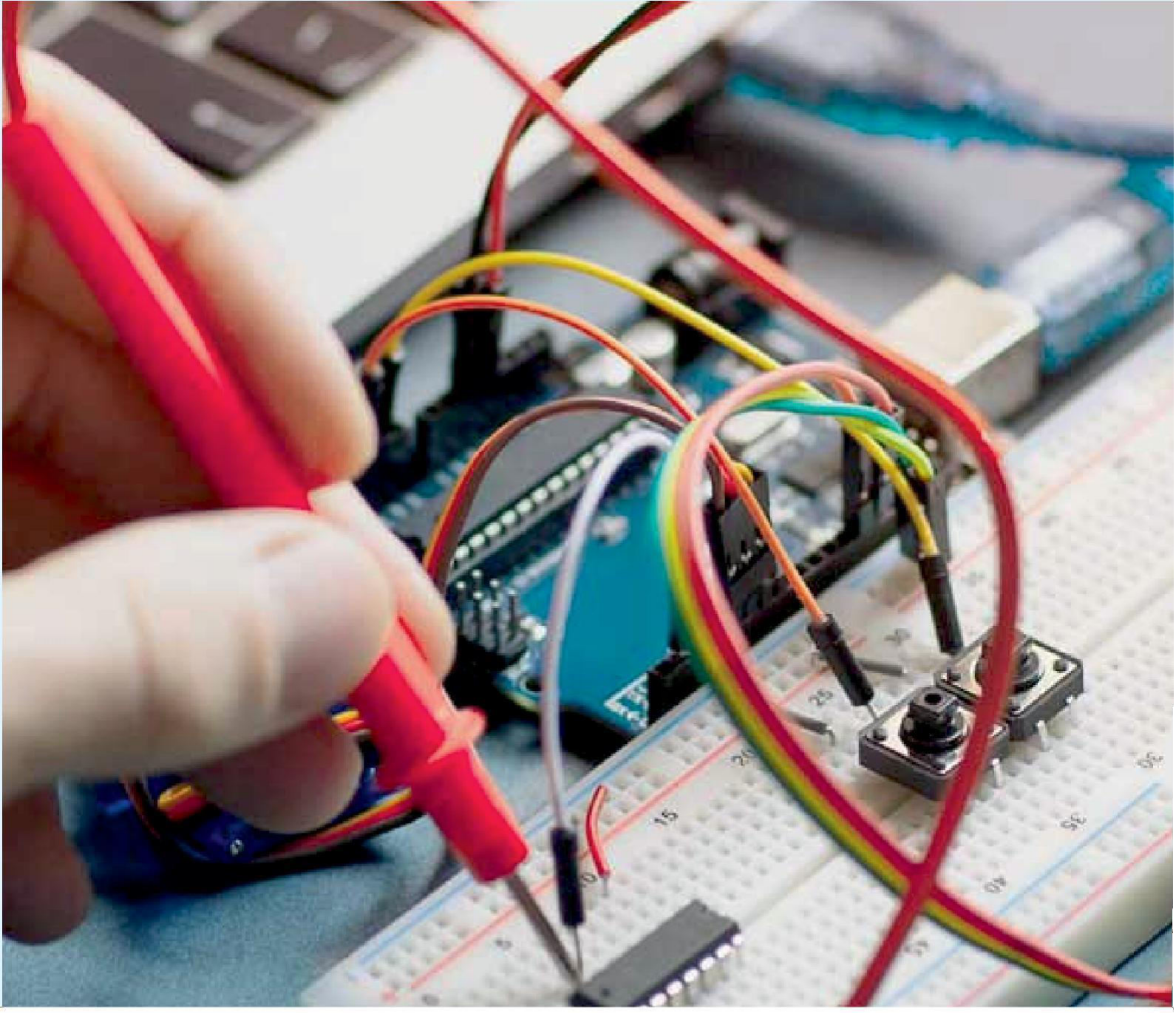

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